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(54) **A DEVICE AND METHOD FOR ADJUSTING THE PRESSURE BETWEEN A FLOOR CLEANING IMPLEMENT AND A FLOOR**

VORRICHTUNG UND VERFAHREN ZUR EINSTELLUNG DES DRUCKES ZWISCHEN EINEM BODENREINIGER UND EINEM BODEN

A DEVICE AND METHOD FOR ADJUSTING THE PRESSURE BETWEEN A FLOOR CLEANING IMPLEMENT AND A FLOOR

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a device for adjusting the pressure between a floor cleaning implement of a floor cleaning machine and a floor. The floor cleaning machine can be one of many types of floor cleaning and treating machines, such as scrubbers, sweepers, and the like.. These types of machines can be used for the cleaning of hard surfaces of large floor areas in hotels, factories, office buildings, shopping centers and the like.

[0002] In general such machines comprise a movable body supported by a pair of drive wheels and one or more caster wheels. With a scrubber, the body carries a scrubbing device, reservoirs for storing fresh and spent cleaning liquid, a device for dosing fresh cleaning liquid onto the floor, and a squeegee/vacuum pickup system for recovering spent cleaning liquid from the floor.

[0003] The scrubbing device normally comprises one or more brushes or scrubbing pads, a motor for driving the brushes, and a device for lifting the brushes off the floor when large areas are traversed without any cleaning action being required.

[0004] A typical conventional floor cleaning machine has the problem in that a force for pressing the pad against the floor-surface is changed during operation, due to various causes such as wear of the pad, reduced voltage of the batteries, state of the floor-surface, and the like, and as a result, the quality level of the polishing job for the floor-surface is changed. If the pad pressure is too strong, there is a possibility that the wax applied to the floor-surface comes off and the floor-surface may be scratched. In contrast, if the pad pressure is too weak, a sufficient polishing effect can not be obtained.

[0005] Conventional devices regulate brush/pad pressure many different ways. For example, some devices monitor the current within the scrubbing motors to determine the brush pressure and adjust the brush pressure actuating the lifting device for the scrubbing assembly. EP 0173394 pertains to a floor cleaning machine comprising an electrical means for controlling the operation of the brush head lever motor to maintain the brush pressure at an operator-set value.

[0006] The present invention has been designed to overcome some of the complications and/or problems inherent in the conventional devices.

SUMMARY OF THE INVENTION

[0007] The present invention relates to a cleaning implement pressure regulating system for a floor cleaning machine:

[0008] The present invention provides a device for regulating the pressure between a floor cleaning implement and a floor, wherein the floor cleaning implement is coupled to a floor cleaning machine. The device comprises a cantilevered arm coupled to the floor cleaning machine

and a sensor coupled to the cantilevered arm and positioned to sense deflection or other deformation of the cantilevered arm. An actuator is coupled between the cantilevered arm and cleaning implements. The actuator is also coupled to the sensor and adapted to receive signals from the sensor to cause actuation of the actuator. When pressure other than a predetermined amount between the floor cleaning implement and the floor causes the cantilevered arm to deform, the sensor senses this deformation and cause the actuator to actuate in a direction that allows the cantilevered arm to return to a position in which the pressure is within the predetermined amount. In some embodiments, the allowable predetermined pressure is a range of pressures.

[0009] One particular embodiment of the present invention provides a floor cleaning machine comprising a motor-driven movable body carrying a cleaning implement assembly which comprises a housing having one or more cleaning implements coupled to the housing. A motor is coupled to the housing and the cleaning implements for driving the cleaning implements. An actuator, such as linear motor, is coupled to the housing for lifting and lowering the housing. An elastically deformable cantilevered arm is coupled to the body and the actuator. A sensor is coupled to the cantilevered arm to sense or measure deformation of the cantilevered arm. A controller is coupled to the sensor and the actuator. The controller actuates the actuator in response to signals from the sensor indicating deformation of the cantilevered arm. Actuation of the actuator adjusts the pressure of the cleaning implements against a floor.

[0010] Another embodiment is directed toward a device for regulating the pressure between a floor cleaning implement and a floor, wherein the floor cleaning implement is coupled to a floor cleaning machine. The device includes a flexible cantilevered arm coupled between to the frame of the floor cleaning machine and the floor cleaning implements. The flexible cantilevered arm is adapted to elastically deform when the pressure between the floor cleaning implement and the floor is other than a predetermined amount. This deformation of the cantilevered arm returns the pressure between the floor cleaning implements and the floor to the predetermined amount.

[0011] Yet other embodiments are directed to a method of regulating pressure between a floor scrubbing implement and a floor.

[0012] Further aspects of the present invention, together with the organization and operation thereof, will become apparent from the following detailed description of the invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1 is a perspective view of a floor scrubbing machine embodying aspects of the present invention.

[0014] FIG. 2 is a schematic representation of a pres-

sure regulation device embodying aspects of the present invention.

[0015] FIG. 3 is a perspective view of a cantilevered arm incorporated in one embodiment of the present invention.

[0016] FIG. 4 is a perspective view of the cantilevered arm shown in FIG. 3, wherein the cantilevered arm is coupled to the frame of a floor cleaning machine and an actuator is coupled to the cantilevered arm.

[0017] FIG. 5 is another perspective view of the cantilevered arm shown in FIG. 3, wherein the cantilevered arm is coupled to the frame of a floor cleaning machine and an actuator is coupled to the cantilevered arm.

[0018] FIG. 6 is another perspective view of the cantilevered arm shown in FIG. 3, with this figure showing the sensor coupled to the cantilevered arm.

[0019] FIG. 7 is another perspective view of the cantilevered arm shown in FIG. 3, with this figure showing the sensor coupled to the cantilevered arm.

[0020] FIG. 8 is a perspective view of the actuator shown in FIGs. 4-7 coupled to the housing of a scrubbing assembly.

DETAILED DESCRIPTION

[0021] Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings.

[0022] Referring now to FIG. 1, a floor cleaning machine 10 is shown, comprising a housing 11, an operator control assembly 12, a scrubbing assembly 13 and a squeegee 14. The cleaning machine 10 is supported on main drive wheels 16 and one or more caster wheels 18. Although it is not illustrated, several items such as a tank, batteries, pumps, motors, and other parts can be housed within the housing 11.

[0023] Although one particular embodiment of the invention will be described in connection with a scrubber, it should be clear that the invention has application to other types of floor maintenance vehicles, such as sweepers and the like. Accordingly, the present invention should not be limited to a scrubber.

[0024] The scrubbing assembly 13 includes a head or housing 20 having one or more cleaning implements 22, such as rotating, orbiting, or reciprocating brushes or pads. A motor 24 is coupled to the housing 20 and the cleaning implements 22 to drive the cleaning implements 22 in a cleaning motion.

[0025] An actuator 26 is also coupled to the housing 20 to lift and lower the housing 20 and cleaning implements 22 relative to the floor. In the illustrated embodiment, a linear motor is used as the actuator 26. However, in other embodiments, other actuators 26 can be used, such as a motor having a rack and pinion gear assembly and the like. The actuator 26 can be used to lift the housing 20 and implements entirely off of the floor. Further,

the actuator 26 can be used to place the implements 22 on the floor and adjust the pressure of the implements 22 on the floor.

[0026] The actuator 26 is coupled to a cantilevered arm 28, which is coupled to the body, frame, or housing of the floor cleaning machine 10. As illustrated, the cantilevered arm 28 has two ends. One end is coupled to the frame of the floor cleaning machine 10. The other end is cantilevered. In the illustrated embodiment, the cantilevered arm 28 is configured in a substantially C-shaped configuration. However, in other embodiments, the cantilevered arm 28 can have other configurations, such as more linear configurations, L-shaped configurations, and the like. Other devices, other than the actuator or linear motor can be coupled to the cantilevered arm 28, which can affect the shape of the cantilevered arm 28.

[0027] Due to the connection of the cantilevered arm 28 to the scrubbing assembly 13, increased pressure or force between the cleaning implements 22 and the floor (caused by imperfections in the floor for example) will cause a force to be applied to the cantilevered arm 28 via the actuator 26 extending between the cantilevered arm 28 and the scrubbing assembly 13. This force applied to the cantilevered arm 28 will cause the cantilevered arm 28 to bend or deform elastically. This elastic deformation can help to reduce undesirable levels of pressure between the cleaning implements 22 and the floor caused suddenly by imperfections in the floor. Once the imperfection is no longer in contact with the cleaning implements 22 (due to translation of the cleaning machine over the floor), the cantilevered arm 28 can return to a non-deflected or non-deformed condition (or to a normal deflection condition) due to elastic forces. As such, the originally desired pressure between the cleaning implements 22 and the floor can be restored.

[0028] In some situations, however, the change in pressure between the cleaning implements 22 and the floor may not be a temporary condition. In such situations, a sensor 30 that is coupled to the cantilevered arm 28 can sense or measure the deformation of the cantilevered arm 28 and cause the actuator 26 to actuate to change the pressure to the desired pressure, which can be a range of pressures. The sensor 30 can be any variety of deflection/deformation sensors. For example, a strain gauge can be used to measure or sense the deformation of the cantilevered arm, as well as Hall-effect sensors, load sensors, optical sensors, ultrasonic sensors, laser sensors, inductive sensors, capacitive sensors, and the like. In some embodiments, contact switches such as microswitches and the like can be used as well. In such an embodiment, sufficient deformation can cause the arm to contact a switch.

[0029] In the illustrated embodiment, a hall-sensor is shown coupled to the cantilevered arm 28. Specifically, as shown, one portion of the sensor 30 is coupled to a portion 34 of the cantilevered arm 28 that is generally not stressed, strained, or otherwise deformed by forced applied to the cantilevered end of the arm during normal

operation. A second portion 36 of the sensor 30 is coupled to a portion of the cantilevered arm 28 that is deformed by forces applied to the cantilevered end of the arm during operation. Accordingly, forces applied to the cantilevered arm during operation, will cause relative movement between the two portions of the sensor 30. As such, the forces applied to the cantilevered arm 28 can be determined.

[0030] In some embodiments, the sensor 30 is in communication with a controller 32, and the controller 32 is coupled to the actuator 26. Accordingly, the controller 32 can actuate the actuator 26 in response to signals from the sensor indicating deformation of the cantilevered arm 28. This actuation of the actuator 26 adjusts the pressure of the cleaning implements 22 against the floor.

[0031] In operation, the actuator 26 can be used to raise and lower the scrubbing or cleaning assembly 13 relative to the floor. For example, when the floor cleaning machine 10 is being transported from one cleaning location to another, the actuator 26 can be actuated to lift the cleaning assembly 13 off of the floor. Once the cleaning assembly 13 reaches a desired location, the actuator 26 can be actuated again to lower the cleaning assembly 13 into contact with the floor. Furthermore, the actuator 26 can continue to actuate to place the cleaning assembly 13 into proper contact with floor. In other words, the actuator 26 can place the cleaning assembly 13 into the desired pressure with the floor.

[0032] During operation, the scrubbing assembly 13 may contact imperfections or other variations in the floor surface. These imperfections or variations may cause a sudden increase in pressure between the cleaning implements 22 and the floor. As previously discussed, such sudden increases in pressure can cause damage to the floor if not promptly addressed. In some situations, the sudden increase in pressure is relieved by the deformation of the cantilevered arm 28. This situation may occur when the imperfection is small and quickly passed over by the floor cleaning machine. In such a situation, the cantilevered arm 28 would return to the non-deflected condition and the correct pressure would be achieved once the imperfection is passed.

[0033] In other situations, the imperfection may be so great, large, or prolonged that elastic deformation of the cantilevered arm 28 may not be sufficient to relieve the pressure. In such situations, the sensor 30 on the cantilevered arm 28 would sense the deflection of the cantilevered arm 28 and cause the actuator 26 to actuate, and thus, reduce the pressure.

[0034] In some situations, the change in pressure may be caused by wear and tear on the cleaning implements 22. In such situations, the cantilevered arm 28 may deform in the opposite direction due the pressure between the cleaning implements 22 and the floor being too low. Accordingly, the sensor 30 would sense a deflection or deformation of the arm 28 and cause the actuator 26 to actuate in a direction that would increase the pressure. The sensor 30 would sense when the pressure is correct

and stop the actuator 26 from actuating. The sensor 30 would sense such a condition when the cantilevered arm 28 is stressed, deformed, or deflected a predetermined amount associated with the proper pressure or force.

[0035] Various features of the invention are set forth in the following claims.

Claims

1. A device for regulating the pressure between a floor cleaning implement (22) and a floor, wherein the floor cleaning implement (22) is coupled to a floor cleaning machine (10), the device comprising:

machine (10);
a sensor (30) coupled to the cantilevered arm (28) and positioned to sense deflection or other deformation of the cantilevered arm (28);
an actuator (26) coupled to the cantilevered arm (28) and the cleaning implement (22), the actuator (26) also coupled to the sensor (30) and adapted to receive signals from the sensor (30) to cause actuation of the actuator (26);

characterized in that the actuator (26) extends between the floor cleaning implement (22) and the cantilevered arm (28), and, when in use, pressure other than a predetermined amount between the floor cleaning implement (22) and the floor causes the cantilevered arm (28) to deform, the sensor (30) senses this deformation and causes the actuator (26) to actuate in a direction that allows the cantilevered arm (28) to return to a position in which the pressure is within the predetermined amount.

2. The device of claim 1 further comprising:

a controller (32) in communication with the sensor and coupled to the actuator,
the controller configured to actuate the actuator in response to signals from the sensor indicating deformation of the cantilevered arm.

3. The device of claim 1, wherein the cleaning implement is included in a cleaning assembly (13), the cleaning assembly having a housing (20) and one or more cleaning implements coupled to the housing.

4. The device of claim 1, wherein the predetermined pressure is a range of pressures.

5. The device of claim 1, wherein the pressure other than the predetermined pressure is a pressure greater than the predetermined pressure.

6. The device of any one of the preceding claims, wherein the actuator is a linear motor.

7. A floor cleaning machine (10), wherein the device of any one of the preceding claims is coupled to the floor cleaning machine.

8. The floor cleaning machine of claim 7 comprising:

a motor-driven movable body;
 a cleaning assembly (13) having a housing (20) and one or more cleaning implements (22) coupled to the housing;
 a motor (24) coupled to the housing and the cleaning implements for driving the cleaning implements.

9. A method for regulating the pressure between a floor cleaning implement and a floor, wherein the floor cleaning implement is coupled to a floor cleaning machine, the method comprising:

providing a cantilevered arm coupled to the floor cleaning machine and a sensor coupled to the cantilevered arm and positioned to sense deflection or other deformation of the cantilevered arm;
 providing an actuator coupled to and extending between the cantilevered arm and cleaning implement, the actuator being coupled to the sensor and adapted to receive signals from the sensor to cause actuation of the actuator;
 operating the floor cleaning machine;
 sensing deformation of the cantilevered arm greater than a predetermined amount;
 actuating the actuator in a direction that allows the cantilevered arm to return to a position in which the deformation of the cantilevered arm is less than the predetermined amount.

Patentansprüche

1. Eine Vorrichtung zum Regulieren des Drucks zwischen einem Bodenreiniger (22) und einem Boden, wobei der Bodenreiniger (22) an eine Bodenreinigungsmaschine (10) gekuppelt ist, die Vorrichtung aufweisend:

einen Kragarm (28), der an die Bodenreinigungsmaschine (10) gekuppelt ist,
 einen Sensor (30), der an den Kragarm (28) gekuppelt ist und positioniert ist, um eine Auslenkung oder eine andere Verformung des Kragarms (28) zu erfassen,
 einen Stellantrieb (26), der an Kragarm (28) und an den Reiniger (22) gekuppelt ist, wobei der Stellantrieb (26) auch an den Sensor (30) gekuppelt ist und zum Empfangen von Signalen von dem Sensor (30) eingerichtet ist, um eine Betätigung des Stellantriebs (26) zu veranlas-

sen,

dadurch gekennzeichnet, dass sich der Stellantrieb (26) zwischen dem Bodenreiniger (22) und dem Kragarm (28) erstreckt und dass beim Verwenden ein Druck, der anders ist, als ein vorgegebener Wert, zwischen dem Bodenreiniger (22) und dem Boden ein Verformen des Kragarms (28) verursacht, der Sensor (30) diese Verformung erfasst und ein Betätigen des Stellantriebs (26) in eine Richtung veranlasst, die es dem Kragarm (28) ermöglicht, an eine Position zurückzukehren, in welcher der Druck sich in dem vorgegebenen Wert befindet.

2. Die Vorrichtung gemäß Anspruch 1, ferner aufweisend:

einen Regler (32), der mit dem Sensor verbunden ist und an den Stellantrieb gekuppelt ist, wobei der Regler konfiguriert ist, um den Stellantrieb in Reaktion auf Signale von dem Sensor zu betätigen, die eine Verformung des Kragarms anzeigen.

3. Die Vorrichtung gemäß Anspruch 1, wobei der Reiniger in einer Reinigungsvorrichtung (13) enthalten ist, wobei die Reinigungsvorrichtung ein Gehäuse (20) hat und ein oder mehrere Reiniger an das Gehäuse gekuppelt sind.

4. Die Vorrichtung gemäß Anspruch 1, wobei der vorgegebene Druck ein Druckbereich ist.

5. Die Vorrichtung gemäß Anspruch 1, wobei der Druck, der anders ist, als der vorgegebene Druck, ein größerer Druck ist, als der vorgegebene Druck.

6. Die Vorrichtung gemäß irgendeinem der vorhergehenden Ansprüche, wobei der Stellantrieb ein Linearmotor ist.

7. Eine Bodenreinigungsmaschine (10), wobei die Vorrichtung gemäß irgendeinem der vorhergehenden Ansprüche an die Bodenreinigungsmaschine gekuppelt ist.

8. Die Bodenreinigungsmaschine gemäß Anspruch 7, aufweisend:

einen motorbetriebenen, bewegbaren Körper, eine Reinigungsvorrichtung (13) mit einem Gehäuse (20) und einem oder mehreren Reinigern (22), die an das Gehäuse gekuppelt sind, einen Motor (24), der an das Gehäuse und die Reiniger gekuppelt ist, um die Reiniger anzutreiben.

9. Ein Verfahren zum Regulieren des Drucks zwischen

einem Bodenreiniger und einem Boden, wobei der Bodenreiniger an eine Bodenreinigungsmaschine gekuppelt ist, das Verfahren aufweisend:

Bereitstellen eines Kragarms, der an die Bodenreinigungsmaschine gekuppelt ist, und eines Sensors, der an den Kragarm gekuppelt ist und positioniert ist, um eine Auslenkung oder eine andere Verformung des Kragarms zu erfassen, Bereitstellen eines Stellantriebs, der an den Kragarm und den Reiniger gekuppelt ist und sich zwischen diesen erstreckt, wobei der Stellantrieb an den Sensor gekuppelt ist und zum Erhalten von Signalen von dem Sensor eingerichtet ist, um eine Betätigung des Stellantriebs zu veranlassen, Betreiben der Bodenreinigungsmaschine, Erfassen einer Verformung des Kragarms, die größer ist, als ein vorgegebener Wert, Betätigen des Stellantriebs in eine Richtung, die es dem Kragarm ermöglicht, an eine Position zurückzukehren, in welcher die Verformung des Kragarms geringer ist, als der vorgegebene Wert.

Revendications

1. Dispositif de régulation de la pression entre un engin de nettoyage du sol (22) et un sol, dans lequel l'engin de nettoyage du sol (22) est couplé à une machine de nettoyage du sol (10), le dispositif comprenant :

un bras en porte-à-faux (28) couplé à la machine de nettoyage du sol (10) ;
 un capteur (30) couplé au bras en porte-à-faux (28) et positionné pour détecter une déflexion ou une autre déformation du bras en porte-à-faux (28) ;
 un actionneur (26) couplé au bras en porte-à-faux (28) et à l'engin de nettoyage (22), l'actionneur (26) étant également couplé au capteur (30) et adapté pour recevoir des signaux en provenance du capteur (30) pour provoquer l'actionnement de l'actionneur (26) ;
caractérisé en ce que l'actionneur (26) s'étend entre l'engin de nettoyage du sol (22) et le bras en porte-à-faux (28), et, en utilisation, une pression autre qu'une quantité prédéterminée entre l'engin de nettoyage du sol (22) et le sol amène le bras en porte-à-faux (28) à se déformer, le capteur (30) détecte cette déformation et amène l'actionneur (26) à s'actionner dans une direction qui permet au bras en porte-à-faux (28) de revenir dans une position dans laquelle la pression est incluse dans la quantité prédéterminée.

2. Dispositif selon la revendication 1 comprenant en

outre :

une unité de commande (32) en communication avec le capteur et couplée à l'actionneur, l'unité de commande étant configurée pour actionner l'actionneur en réponse à des signaux en provenance du capteur indiquant une déformation du bras en porte-à-faux.

3. Dispositif selon la revendication 1, dans lequel l'engin de nettoyage est inclus dans un ensemble de nettoyage (13), l'ensemble de nettoyage ayant un logement (20) et un ou plusieurs engins de nettoyage couplés au logement.
4. Dispositif selon la revendication 1, dans lequel la pression prédéterminée est une plage de pressions.
5. Dispositif selon la revendication 1, dans lequel la pression autre que la pression prédéterminée est une pression supérieure à la pression prédéterminée.
6. Dispositif selon l'une quelconque des revendications précédentes, dans lequel l'actionneur est un moteur linéaire.
7. Machine de nettoyage du sol (10), dans laquelle le dispositif selon l'une quelconque des revendications précédentes est couplé à la machine de nettoyage du sol.
8. Machine de nettoyage du sol selon la revendication 7 comprenant :
 un corps mobile entraîné par un moteur ;
 un ensemble de nettoyage (13) ayant un logement (20) et un ou plusieurs engins de nettoyage (22) couplés au logement ;
 un moteur (24) couplé au logement et aux engins de nettoyage pour entraîner les engins de nettoyage.
9. Procédé de régulation de la pression entre un engin de nettoyage du sol et un sol, dans lequel l'engin de nettoyage du sol est couplé à une machine de nettoyage du sol, le procédé comprenant les étapes consistant à :
 fournir un bras en porte-à-faux couplé à la machine de nettoyage du sol et un capteur couplé au bras en porte-à-faux et positionné pour détecter une déflexion ou une autre déformation du bras en porte-à-faux ;
 fournir un actionneur couplé à et s'étendant entre le bras en porte-à-faux et l'engin de nettoyage, l'actionneur étant couplé au capteur et adapté pour recevoir des signaux en provenance du

capteur afin de provoquer l'actionnement de l'actionneur ;
faire fonctionner la machine de nettoyage du sol ;
détecter une déformation du bras en porte-à-faux plus grande qu'une quantité prédéterminée ;
actionner l'actionneur dans une direction qui permet au bras en porte-à-faux de retourner dans une position dans laquelle la déformation du bras en porte-à-faux est plus petite que la quantité prédéterminée.

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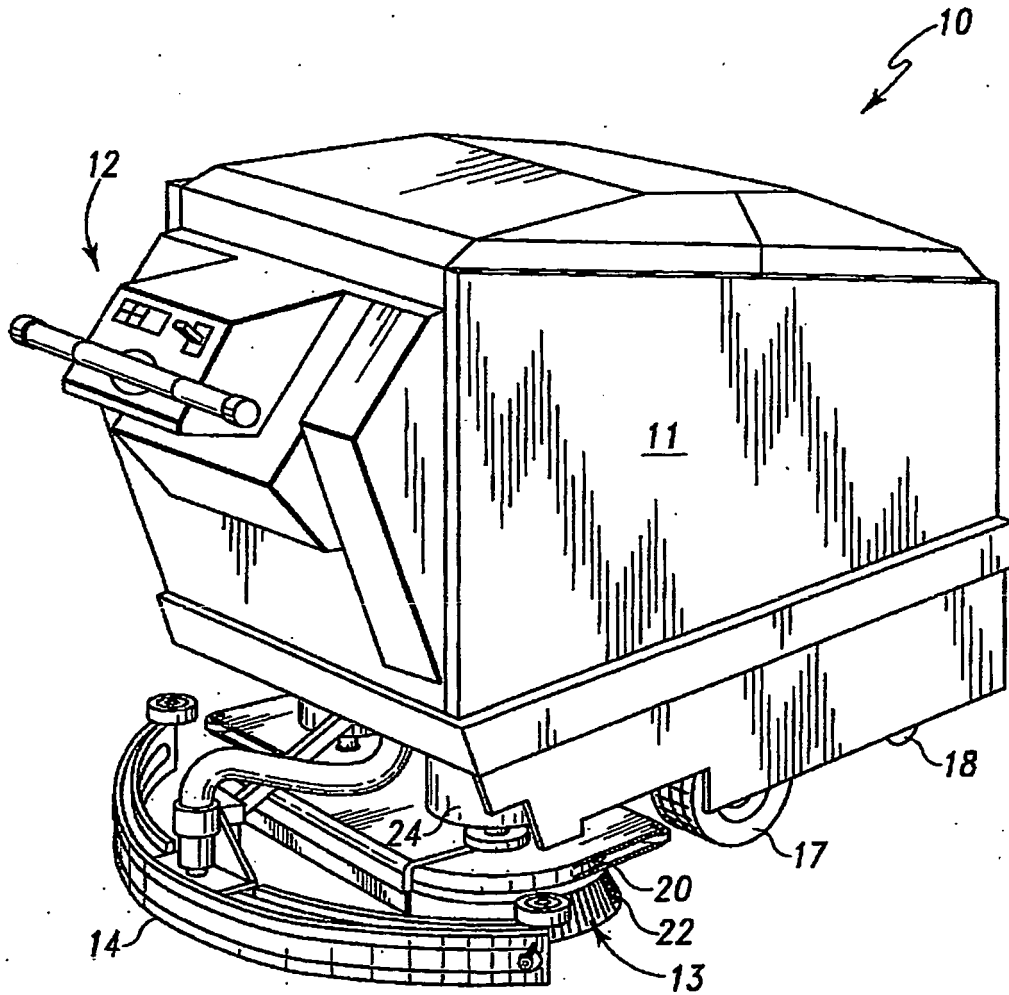


Fig. 1

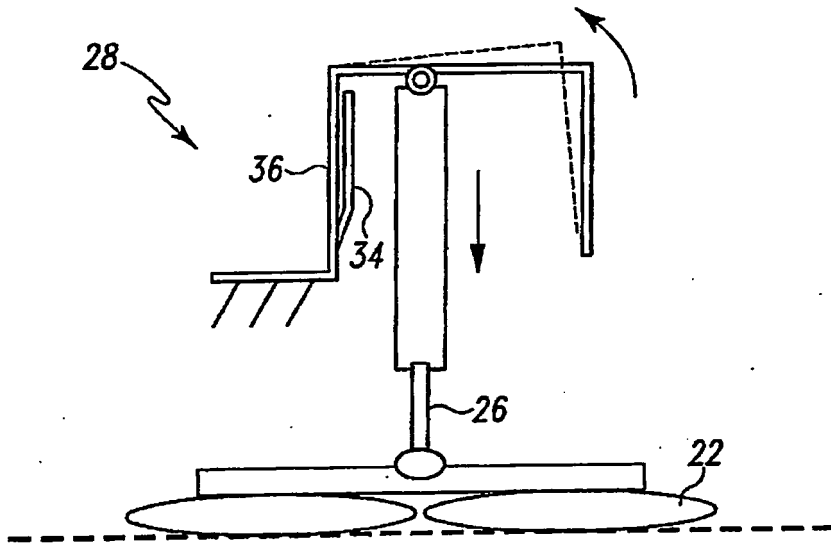


Fig. 2

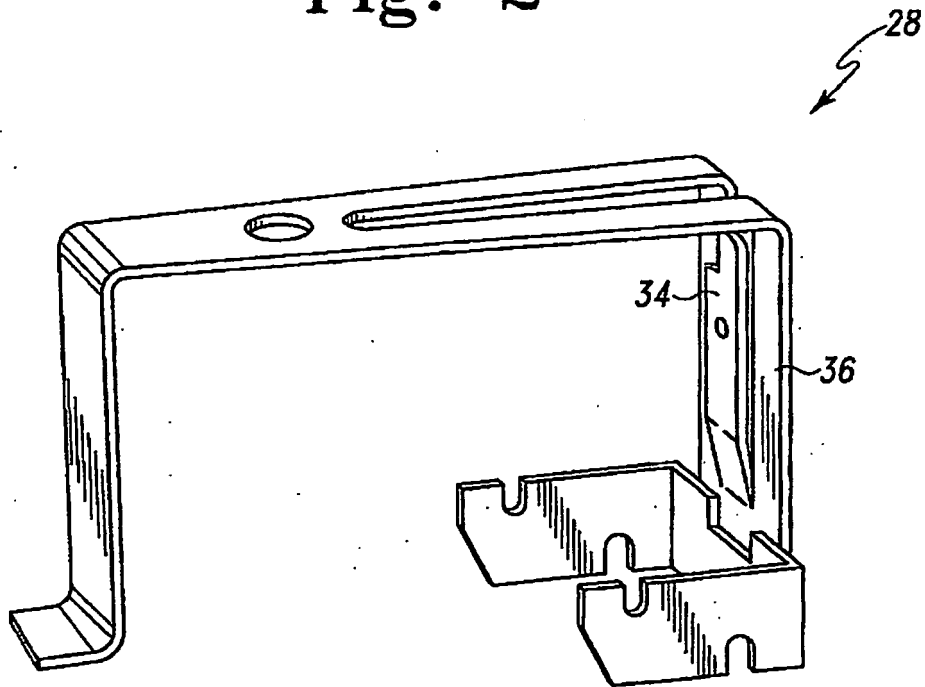


Fig. 3

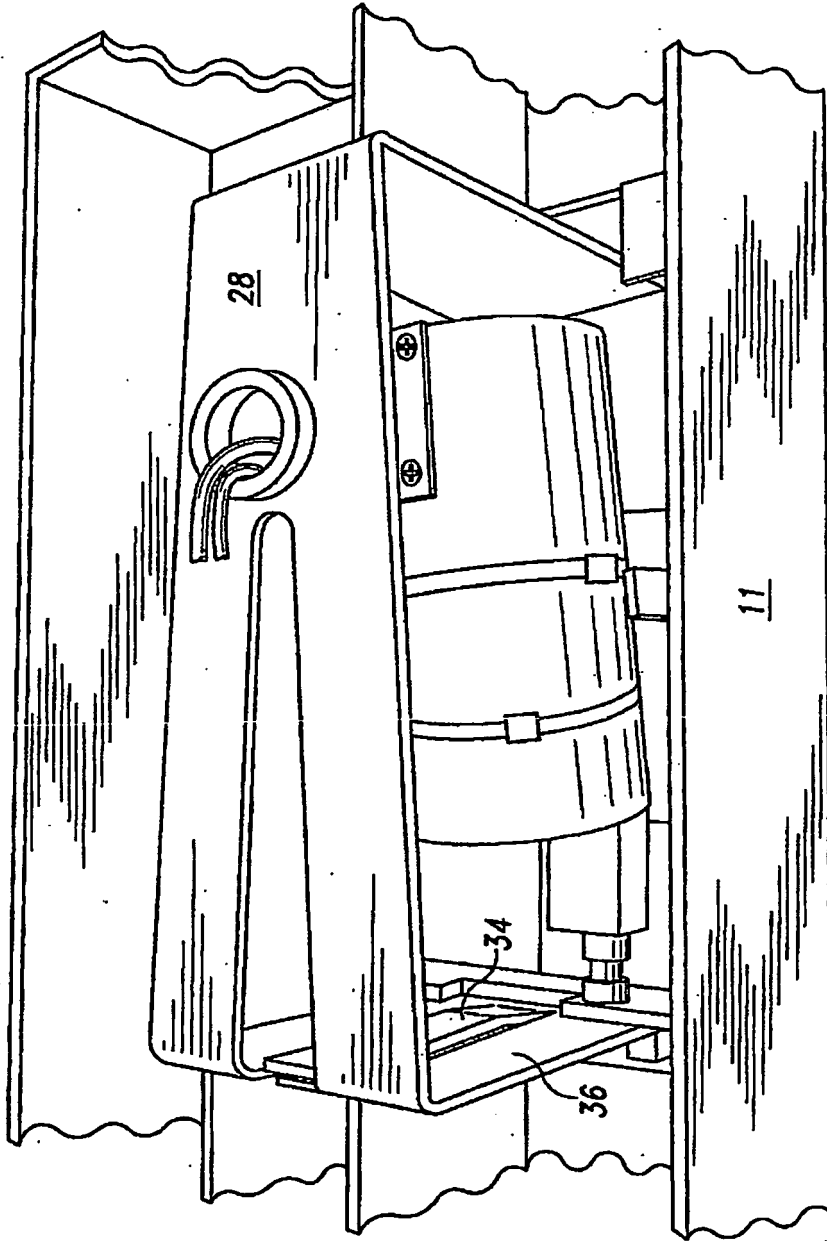


Fig. 4

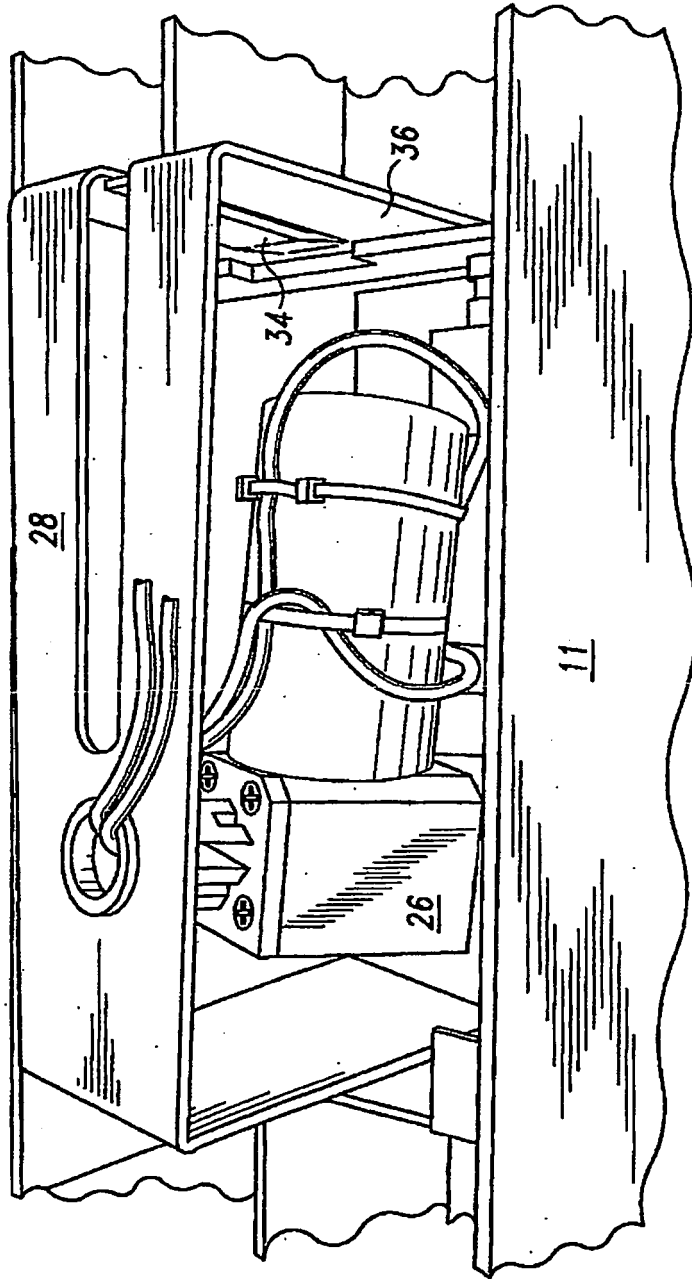


Fig. 5

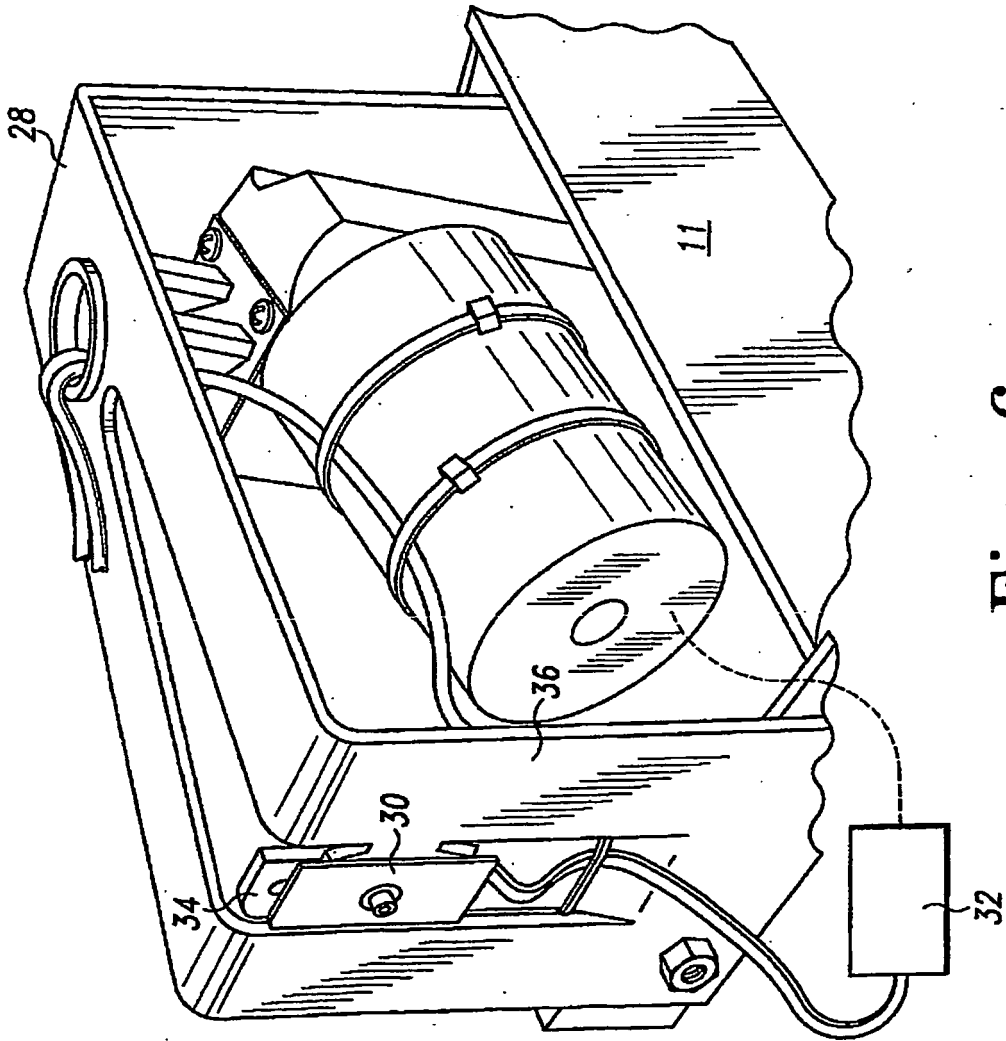


Fig. 6

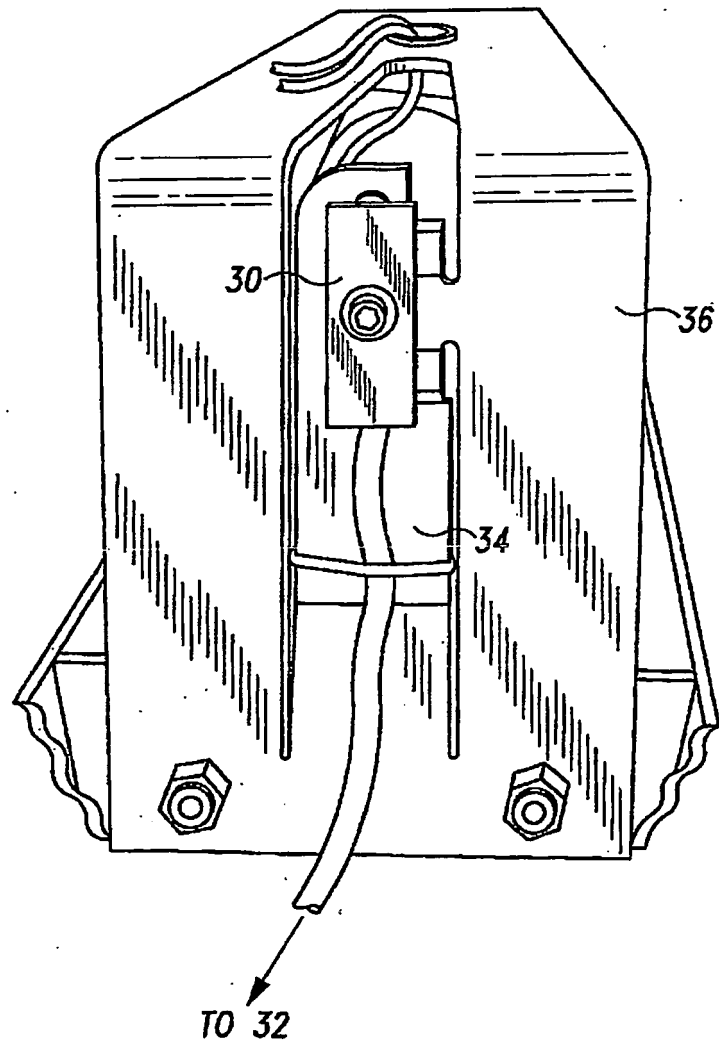


Fig. 7

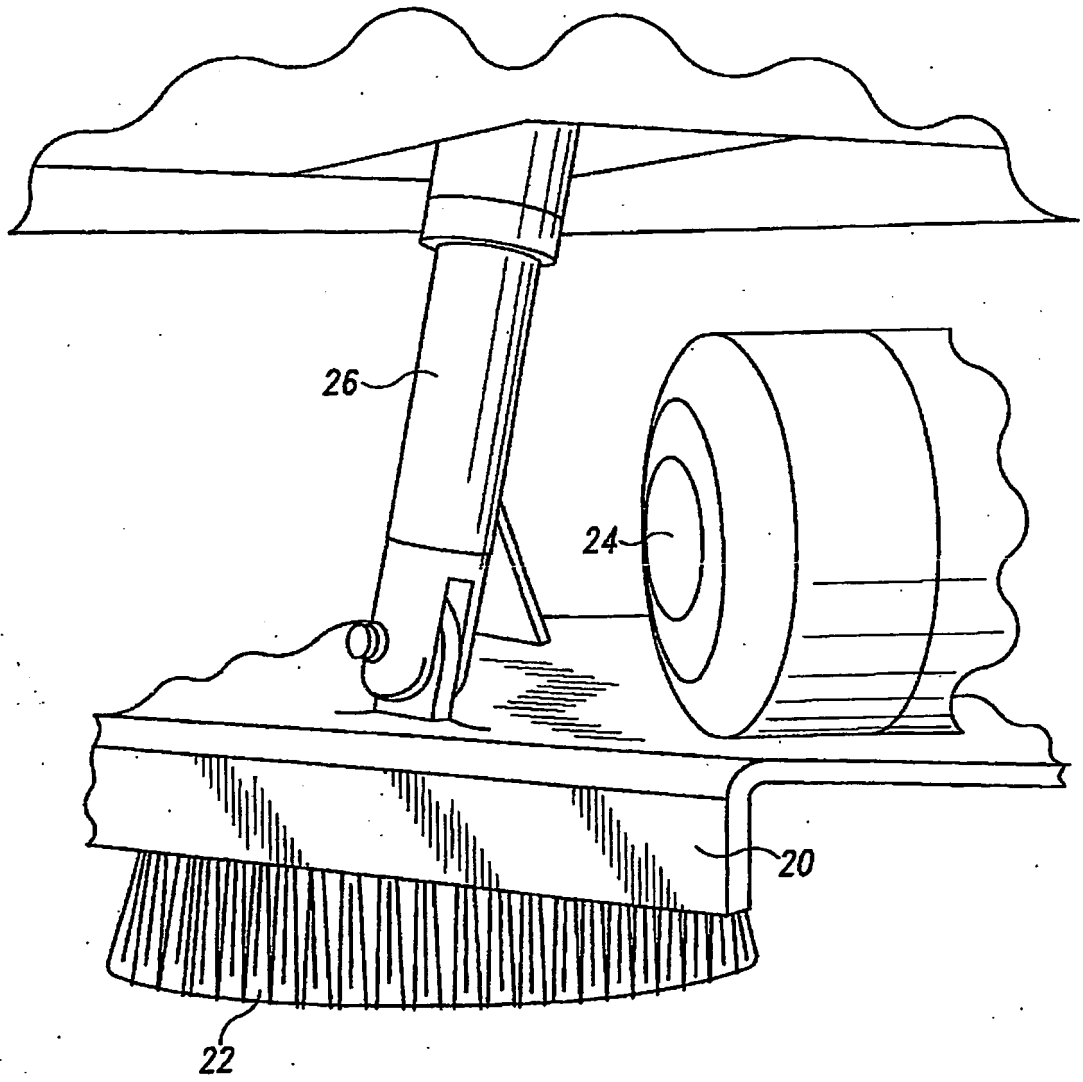


Fig. 8

REFERENCES CITED IN THE DESCRIPTION

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